

HONEYWELL INTERNATIONAL V.
HAMILTON SUNDSTRAND

PETER J. SUTTIE
06/29/00

1 Q That is the B sub C that is referred to in the
2 bottom sentence of page 2, and also in Table 2 on page
3; is that right?

4 A Table 2 on page 3? Yes.

5 Q And also the bottom sentence on page 2; right?
6 A Yes.
7 Q Now, if you go up to the bullet points
8 immediately under Number 2 on page 2, you see there's a
9 line talking about delta P over P. The last bullet in
10 the table.

11 A Here? Delta P divided by P static?

12 Q Yes, sir. Do you see that line?

13 A Yes.

14 Q Do you see all the way on the right-hand side
15 of that is the notation, what I take to be "relative
16 divided by absolute pressure"; do you see that?

17 A Yes.

18 Q First of all, am I right that the abbreviations
19 stand for "relative divided by absolute pressure"?

20 A That's the way I understand it.

21 Q In the APS 3200 is the delta P over P
22 measurement a measurement of relative divided by
23 absolute pressure?

24 A It's a measurement of a delta pressure which is
25 one pressure subtracted from another. That makes it a

1 Q Am I right that the APS 3200 measures -- well,
2 exhaust gas temperature, what's the gas that's being
3 measured there?

4 A A mixture of hydrocarbon exhaust fumes, oxygen,
5 nitrogen. Air that's being consumed by the power
6 section, power of the APU burned in the combustor,
7 expanded through the turbine and exhausted through the
8 APU.

9 Q And in the APS 3200, is the measurement of the
10 exhaust gas temperature used to control any of the
11 control systems for the APS 3200?

12 A Yes.

13 Q What system or systems?

14 A It is used to control fuel flow during the
15 acceleration control.

16 Let me clarify that it can be used. It is not
17 always used. And it can also be used, but not always,
18 to control IGV position.

19 Q Anything else that that measurement is used to
20 control in the APS 3200?

21 A That's all I can recall right now.

22 Q Why is the exhaust gas temperature used to
23 control the position of the inlet guide vanes?

24 A As I said, it's not always, but it can be. And
25 the purpose is, as the inlet guide vane angle opens,

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1 relative quantity. The denominator of the equation is P
2 static, which is an absolute pressure.

3 Q So am I correct that in the APS 3200 the
4 delta P over P measurement is a measurement of relative
5 divided by absolute pressure?

6 A Yes.

7 Q Do you see Number 1 on the second page here
8 refers to exhaust gas temperature?

9 A Number 1 here?

10 Q Yes, sir.

11 A Yes.

12 Q And that sometimes is abbreviated EGT; correct?

13 A Correct.

14 Q In the APS 3200, what is the exhaust gas

15 temperature, or EGT?

16 A It varies on load condition.

17 Q Where is it measured?

18 A In the exhaust duct of the APU.

19 Q Is the exhaust duct the duct that leads from
20 the bleed valve out of the airplane?

21 A No.

22 Q All right. Well, what's the exhaust duct of
23 the APU?

24 A Leaves from the turbine section of the APU out

25 of the airplane.

1 more air goes through the load compressor. That applies
2 greater shaft load to the APU power section. Increasing
3 the shaft load on an APU would initially try and drop
4 the speed. Speed control algorithm then adds more fuel
5 into the combustor to compensate for the additional
6 load.

7 One of the by-products of the additional fuel
8 is increased temperature in the hot section of the APU.
9 Hot section of the APU is made with high temperature
10 metals, but that doesn't mean they can resist all
11 temperatures. So you need to ensure that they do not
12 get too hot. And so thermocouples measure the exhaust
13 gas and are used to regulate the load so that the
14 turbine section and the combustor section of the APU do
15 not run beyond their design point temperatures.

16 Q So am I right that a high or an elevated
17 exhaust gas temperature may suggest that the inlet guide
18 vanes should be moved more closed; correct?

19 MR. McCACKEN: Objection; vague.

20 THE WITNESS: What do you mean by high EGT?
21 BY MR. PUTNAM:

22 Q I'm just trying to make sure I understand the
23 directional relationship. As I understand your answer,
24 directionally higher EGT means you should close the
25 inlet guide vanes, understanding that there are other

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23 (Pages 280 to 283)

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1 factors at work?
 2 A Not necessarily closed. But certainly not open
 3 further.
 4 Q And maybe closed somewhat, if not closed all
 5 the way; correct?
 6 A Potentially.
 7 Q Let me show you Exhibit 36 that was marked in
 8 Mr. Szillat's deposition a couple days back.
 9 Do you have Exhibit 36 in front of you, sir?
 10 A Yes.
 11 Q Can you tell me if you recognize this document?
 12 A I don't recall it.
 13 Q It indicates pretty clearly that it's from
 14 Mr. Szillat, and then the people to whom it's to seem to
 15 be abbreviated in some way. Is that some sort of e-mail
 16 code or something referring to individuals in the "to"
 17 line?
 18 A These are log-on IDs for the computer system.
 19 Q Is your log-on ID included in either the "to"
 20 line or the "cc" line at the bottom of the page of
 21 Exhibit 36?
 22 A Yes.
 23 Q Can you tell me what your log-on ID is?
 24 A ANEPAPS.
 25 Q So am I right that you're listed as the first

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1 A Yes. It's currently in Europe right now. But
 2 we maintain it.
 3 Q Okay. Do you remember discussion in or about
 4 January of 1999 of using a different delta P over P
 5 setpoint?
 6 A Not specifically.
 7 Q Do you remember any discussion along these
 8 lines?
 9 A I have tasked John Szillat trying, in our next
 10 version of software, to further improve the control
 11 system. And this was one area he was looking at.
 12 Q And do you remember if he came back with any
 13 suggestions about how the delta P over P setpoint would
 14 be improved --
 15 A I don't --
 16 Q -- or changed?
 17 A I don't recall. I know we aren't making any
 18 changes to it.
 19 Q So you're not planning to change -- you know of
 20 no plans by Sundstrand to change the BCV setpoint from
 21 being a function of inlet gas temperature -- I'm sorry,
 22 of inlet temperature; correct?
 23 A Correct.
 24 Q In the current operation of the APS 3200, am I
 25 right that there's a linear relationship between inlet

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1 recipient of this document?
 2 A Yes.
 3 Q Do you remember receiving this document in
 4 January of 1999?
 5 A I don't.
 6 Q Do you see the bottom item, Number 5, says,
 7 "BCV control setpoint"?
 8 A Yes.
 9 Q Okay. I have a couple of questions. First of
 10 all, do you see in parentheses after that, on the
 11 heading it says "no PCR"?
 12 A Yes.
 13 Q What does PCR stand for?
 14 A Problem and corrective action report.
 15 Q And that's a form that Sundstrand uses for
 16 reporting problems and talking about the corrective
 17 action that might be taken for them; is that right?
 18 A It's a form of engineering change control for
 19 software.
 20 Q Do you see the first line refers to Q22 tests?
 21 A Yes.
 22 Q What's a Q22?
 23 A It's a qualification APU.
 24 Q So is that a test APS 3200 that Sundstrand
 25 maintains at its facilities?

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1 temperature and the BCV setpoint?
 2 A Yes.
 3 Q And that relationship is coded into the
 4 software that's loaded into APS 3200; correct?
 5 A Yes.
 6 Q Do you remember if there were any -- turning
 7 you back to Exhibit 36, do you remember if there were
 8 any specific alternate setpoints that were discussed by
 9 Mr. Szillat or others?
 10 A I don't recall.
 11 Q Do you see a reference in the second line under
 12 the heading Number 5 to the performance group?
 13 A Yes.
 14 Q Who or what is the performance group?
 15 A Department within our engineering organization
 16 tasked with performance of APUS.
 17 Q And are you a member of the performance group?
 18 A No.
 19 Q Who is?
 20 A The manager of the organization is a guy called
 21 Jesse Garcia. There are about five other people. There
 22 was Ehrmentrout, Walter Ainsley, Mike Stock. I think a
 23 couple of young engineers I'm not familiar with.
 24 Q Do you supervise the performance group?
 25 A No.

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24 (Pages 284 to 287)

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1 Q Do they report to you at some level?
 2 A No.
 3 Q Can you explain to me what you mean by -- what
 4 you understand by the concept of integral control?
 5 A Laplace transform terminology, it's 1 over 'x,
 6 which means that the output is an integral function of
 7 the input.
 8 Q And is integral control also related to
 9 measurements over time?
 10 A Not necessarily.
 11 Q Have you ever heard of the phrase
 12 "time-integral"? Time, hyphen, integral?
 13 A I don't recall hearing the phrase.
 14 Q Would you have an understanding of the phrase
 15 "time-integral"?
 16 A I would assume that meant an integral with
 17 respect to time.
 18 Q And what would be an integral with respect to
 19 time?
 20 A Can you define the question? It's very
 21 open-ended.
 22 Q The integral volume used in the APS 3200, is
 23 that a type of control that uses an integral with
 24 respect to time?
 25 MR. McCRACKEN: Objection; ambiguous.

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1 MR. PUTNAM: Why don't we take a short break.
 2 (Recess.)
 3 (Deposition Exhibit 46 marked.)
 4 BY MR. PUTNAM:
 5 Q Mr. Suttie, let me hand you what the reporter
 6 has marked as Suttie Deposition Number 46, which is a
 7 multi-page document with production numbers 176217
 8 through 176295. And also handwritten numbers 1 of 79
 9 through 79 of 79 in the top right-hand corner of the
 10 document. Do you have that document in front of you?
 11 A I have a document that covers those numbers,
 12 yes.
 13 Q Can you tell me if you recognize the document
 14 or any portion of it?
 15 A I recognize the document.
 16 Q Can you tell me what it is, please?
 17 A It was a presentation to then-known as MBB
 18 concerning the APS 3200.
 19 Q Who or what is MBB?
 20 A MBB is Messerschmidt Balcow Blohm, which is the
 21 predecessor of D.A. that we talked about earlier. Same
 22 company, different name.
 23 Q So this was a presentation that Sundstrand had
 24 put together for the entity that's now known as Airbus;
 25 correct?

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1 THE WITNESS: When you say the integral control
 2 in APS 3200, which integral control do you mean?
 3 BY MR. PUTNAM:
 4 Q The integral control in the APS 3200 that is
 5 applied to the difference between the measured value of
 6 delta P over P and the setpoint value, is that a type of
 7 integral control that uses an integral with respect to
 8 time?
 9 A Can you repeat that, please?
 10 (Record read.)
 11 THE WITNESS: Yes.
 12 BY MR. PUTNAM:
 13 Q Did I take Exhibit 36 from you?
 14 MS. REZNIK: Yes. Do you want it back?
 15 MR. PUTNAM: It's not very fair to ask you
 16 questions about it without showing it to you.
 17 Q Let me hand you Exhibit 36, which I prematurely
 18 took from you. The last sentence of the memo says, "If
 19 a change is proposed," talking still about the change or
 20 potential change to the BCV test point, "then engine
 21 tests would be conducted with the alternate setpoint to
 22 ensure no adverse control impact." Do you see that?
 23 A I do.
 24 Q Were any such engine tests ever conducted?
 25 A I don't recall.

1 A Yes.
 2 Q And do you see the second and third pages of
 3 the document, and the fourth as well, are handwritten
 4 pages that are all dated in March of 1990?
 5 A Pages 2 and 3?
 6 Q And 4 as well.
 7 A I'm assuming page 4 is 1990. It's not very
 8 clear to see.
 9 Q In any event, is it consistent with your memory
 10 that this presentation to Airbus took place in the early
 11 part of 1990?
 12 A No. As I look at this document, it's actually
 13 a conglomeration of multiple documents, even though it's
 14 being listed as an Attachment 3. There are multiple
 15 presentations here. The first cover page, for example,
 16 was a presentation made in September 13th, 1989. I see
 17 later references, as you point out, to 1990, and there's
 18 some other references to November of '89. This is
 19 actually a compilation of presentations.
 20 Q Okay. The part of this that you recall being a
 21 presentation to Airbus, is that the -- let's do it this
 22 way: Are the pages that say "APS 3000 review, 9/13/89,"
 23 as does the cover and does, for example, page 7 of 79,
 24 are those part of what you recall being the presentation
 25 to Airbus?

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25 (Pages 288 to 291)

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1 A They were that particular presentation to
2 Airbus. But some of the latter pages were other
3 presentations to Airbus.

4 Q Okay. And from the date, am I right that this
5 was a presentation that Sundstrand made about the APS
6 3000 or 3200 to Airbus in September, 1989?

7 A Correct.

8 Q Can you turn, please, to the page that's
9 numbered in the top right 10 of 79?

10 Do you see this refers to the load compressor
11 control for the 3200?

12 A Load compressor controls, yes.

13 Q And on the heading it says, "basis T40LC." Do
14 you see that?

15 A Yes.

16 Q What does that mean?

17 A T40 is a model of APU and LC stands for load
18 compressor.

19 Q Who makes the T40 APU?

20 A Sundstrand.

21 Q Does Sundstrand currently make the T40 APU?

22 A I believe so.

23 Q Does the T40 APU have adjustable inlet guide

24 vanes?

25 A Yes.

1 the operation of surge control on the KC-135?

2 MR. MCCRACKEN: Objection; relevance.

3 THE WITNESS: I don't know.

4 BY MR. PUTNAM:

5 Q Do you have any possible candidates?

6 A I would start with the person and ask them. If
7 they didn't know, I would follow to someone else.

8 Q Who is the person you would start with?

9 A Paul --

10 MR. MCCRACKEN: Objection; relevance. I'll

11 just enter a standard objection, relevance on the issue
12 of KC-135, so I don't have to keep interrupting.

13 MR. PUTNAM: Okay.

14 Q Who's the person you would start with?

15 A Paul Hilgeman.

16 Q Spell that last name.

17 A H-i-l-g-e-m-a-n.

18 Q Am I right that you cannot give me testimony on
19 the operation of the KC-135 or T40 surge control system?

20 A You're right.

21 Q Can you give me testimony on the operation of
22 the KC-135 or T40 engine fuel control start-up system?

23 A No.

24 Q Do you recall discussing with Airbus at this
25 meeting the fact that, as you say here on page 10, surge

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1 Q For what airplane has the T40 APU been sold?
2 A As I understand, it's the KC-135 that we talked
3 about in the last deposition.

4 Q So your understanding is the T40 APU is made
5 for the KC-135; correct?

6 A Yes.

7 Q And does this indicate that you told Airbus in
8 September, 1989, that the load compressor for the
9 controls of the APS 3200 would be based on the
10 Sundstrand T40 APU?

11 A It would be based on, yes.

12 Q Do you see the second major bullet down on the
13 page refers to surge control as a function of inlet
14 guide vane angle?

15 A I do.

16 Q And is it accurate that at least as of
17 September, 1989, it was contemplated that the APS 3200
18 would have surge control as a function of inlet guide
19 vane angle?

20 A As of 1989, during the proposal it was
21 contemplated, yes.

22 Q For the T40 or KC-135 APU is surge protection
23 similarly a function of inlet guide vanes?

24 A I don't know.

25 Q Who would be the best person to tell me about

1 control for the APS 3200 was going to be or was
2 contemplated as being a function of the inlet guide vane
3 angle?

4 A I did not participate in that meeting.

5 Q Who did?

6 A Malcolm McArthur.

7 Q Who was Malcolm McArthur in September, 1989?

8 A In September, '89 he was my supervisor.

9 Q Do you recall discussing with Mr. McArthur
10 after the meeting whether this issue of surge control as
11 a function of inlet guide vane angle came up during that
12 meeting?

13 A I don't recall.

14 Q If you turn over to page 17. Again following
15 the pages in the upper right-hand corner of the
16 document. Am I right that this shows a contemplated
17 control system for the APS 3200 in which the delta P
18 over P setpoint is a function of the inlet guide vane
19 angle?

20 A Can you repeat that, please?

21 (Record read.)

22 THE WITNESS: Yes, this would contemplate it.
23 But as I mentioned in the last deposition, it was never
24 built.

25 BY MR. PUTNAM:

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1 Q AM I right, in looking at the lower right-hand
2 corner of page 17, you are the author of this
3 contemplated control diagram?
4 A No.
5 Q Why is it your name appears with the date
6 March, 1990?
7 A I presented this. But the diagram is, you will
8 note, exactly the same as the proposal diagram we
9 discussed during my last deposition. So it was cut and
10 pasted from the proposal.
11 Q When you say the "proposal diagram," what do
12 you mean by the proposal diagram?
13 A I don't remember your exhibit number, but it
14 was one of the documents we discussed.
15 Q And what do you mean by the term "proposal"?
16 A Technical proposal to MBB for the APS 3000, as
17 it was then called.
18 Q Can you give me testimony on the source of the
19 control system depicted here on page 17? Where did it
20 come from?
21 A There were two questions there.
22 Q Let me restate the question. Can you give me
23 testimony on how the control system depicted here on
24 page 17, in particular the use of the inlet guide vane
25 to effect the setpoint, how that was created?

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1 IGV angle?
2 A I don't recall.
3 Q Wendell Reed was a Sundstrand employee;
4 correct?
5 A Yes.
6 Q How had he come up with the idea of basing the
7 setpoint on IGV angle?
8 A I don't know.
9 Q Is Wendell Reed a current Sundstrand employee?
10 A No.
11 Q Let me ask you this question, Mr. Suttie: Are
12 you aware of any surge control system in actual
13 operation prior to February, 1980, that utilized all of
14 the following aspects: Measurement of a flow-related
15 parameter, proportional and integral control, and the
16 position of the inlet guide vanes?
17 A I know there were some papers which were
18 obtained showing surge control for large engines which
19 appeared to use these parameters, but I don't know the
20 details.
21 Q Okay. What papers are you talking about?
22 A I need to go pull -- actually, ask to get them
23 pulled out again. I don't have them to my hand. I just
24 know they were being looked for.
25 Q In connection with this litigation?

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1 MR. McCACKEN: Objection; vague.
2 THE WITNESS: Please restate it. I don't
3 understand.
4 MR. PUTNAM: Let me try and have her read it
5 back.
6 (Record read.)
7 THE WITNESS: Is the question can I give you
8 testimony? Or can I tell you how it was created?
9 BY MR. PUTNAM:
10 Q Can you tell me how it was created?
11 A No.
12 Q Can you tell me why this system, as depicted
13 here on page 17, was or was not employed in the final
14 APS 3200?
15 A As I mentioned in my last deposition, this
16 diagram is put together by Wendell Reed. At the time we
17 believed that this would be a control system which would
18 function to meet the requirements of the APS 3200. As
19 time went by, we obtained information from Turbomeca
20 that indicated that the delta p on p setpoint was not a
21 function of IGV angle, and therefore, there was no need
22 to make the setpoint a function of IGV angle. We
23 eliminated that function completely.
24 Q And who from Turbomeca told you what that led
25 you to believe that delta P over P was not a function of

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1 A Yes.
2 Q Let me be specific about my question. My
3 question is, are you aware of any surge control system
4 in actual operation, not a paper, but a surge control
5 system in actual operation prior to February, 1990 that
6 utilized all of the following aspects: Measurement of a
7 flow-related parameter, proportional and integral
8 control, and the position of the inlet guide vanes?
9 A I am not aware of any.
10 Q Actually, my colleague points out what's either
11 a misstatement by me or a typo by the able court
12 reporter. So let me just restate the question so that
13 the record is clear.
14 So you know, so you don't have to parse
15 through, it has to do with the date which I meant to be
16 February, 1980 but I may have said the second time
17 around as February, 1990. Let me restate the question.
18 February, 1980 is the date I want.
19 Here's question: Are you aware of any surge
20 control system in actual operation, not on paper, but a
21 surge control system in actual operation prior to
22 February, 1980, that utilized all of the following
23 aspects: Measurement of a flow-related parameter,
24 proportional and integral control, and the position of
25 the inlet guide vanes?

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1 A I'm not aware of any.
 2 MR. PUTNAM: And for the record, the court
 3 reporter has been doing a great job, so I'm sure it's my
 4 mistake.
 5 MR. MCCRACKEN: We didn't presume otherwise.
 6 (Deposition Exhibit 47 marked.)
 7 BY MR. PUTNAM:
 8 Q Mr. Suttie, let me hand you what's been marked
 9 as Suttie Exhibit Number 47, which is a one-page
 10 document with production number HSB 215483, and ask if
 11 you recognize this document?
 12 A I don't recall it. I recognize it, but I don't
 13 recall it.
 14 Q Do you see that it's a memo from Mr. Hardy
 15 dated December, 1992?
 16 A Yes.
 17 Q And do you see that in the bottom middle of the
 18 page you're one of the individuals to whom it was
 19 distributed at Sundstrand?
 20 A Yes.
 21 Q Do you see in the middle page, Mr. Hardy says,
 22 "It appears necessary to use a delta P over P setpoint
 23 function of IGV setting angle"?
 24 A I do.
 25 Q Do you know why it is that Mr. Hardy reached

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1 that conclusion?
 2 A No.
 3 Q Do you see in the bottom middle of the
 4 document, where the box that says "distribution to SPS,"
 5 someone has written in handwriting, "Assigned Suttie"?
 6 A Yes.
 7 Q First of all, do you know whose handwriting
 8 that is?
 9 A Yes.
 10 Q And whose is it?
 11 A Steve Gates.
 12 Q And he was your boss at the time?
 13 A Yes.
 14 Q Do you remember being assigned by Mr. Gates to
 15 respond to Mr. Hardy's conclusion that it was necessary
 16 to use delta P over P setpoint function of inlet guide
 17 vane angle?
 18 A I don't recall.
 19 (Deposition Exhibit 48 marked.)
 20 BY MR. PUTNAM:
 21 Q Mr. Suttie, let me hand what you the court
 22 reporter has marked as Suttie Deposition Exhibit
 23 Number 48, which is a two-page memo, dated January,
 24 1993, production numbers HSB 215481 and 482.
 25 Do you have that document in front of you?

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1 A Yes.
 2 Q And you see again in the bottom middle of the
 3 page someone has assigned you, Mr. Hardy -- I'm sorry,
 4 Mr. Gates has assigned you to respond to this document?
 5 A Yes.
 6 Q This is from a Mr. Biscay; do you see that?
 7 A Yes.
 8 Q Who is that?
 9 A Aerodynamics engineer at Turbomeca.
 10 Q If you turn to the second page of the document,
 11 you see a heading that says, "Relation delta P over P
 12 versus IGV actuator position"?
 13 A I do.
 14 Q What is the import of what's set out at that
 15 part of the document?
 16 MR. MCCRACKEN: Objection; vague.
 17 THE WITNESS: What do you mean by the import?
 18 BY MR. PUTNAM:
 19 Q What's he talking about?
 20 A Appears to be making a proposal to make the
 21 delta P over P setpoint a function of some numbers. And
 22 then a value X.
 23 Q What does the X stand for there?
 24 A It says "X in percent" above. Previously it
 25 says, "Let X be the IGV actuator position in percent."

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1 Q Now, this document is dated January, 1993. Do
 2 you know when it was that Sundstrand decided not to use
 3 IGV position to establish the delta P over P setpoint?
 4 A Approximately the year 1990.
 5 Q My question was decided not to use. Did you
 6 hear that?
 7 A Decided not to use IGV.
 8 Q Yes.
 9 A The proposal we discussed already in 1989
 10 showed IGV. By mid 1990 or the end of 1990 we decided
 11 not to use IGVs and never again used IGVs in any of our
 12 documentation or thought processes.
 13 Q Okay. And my question, then, is what's the
 14 explanation of both Exhibits 47 and 48 from December,
 15 '92 and January, '93 that show at least Turbomeca saying
 16 we need to use IGV position for the setpoint?
 17 A I don't know. We never did it.
 18 Q As of mid or the end 1990, when you say you
 19 decided not to use IGVs, at that point did you go to a
 20 fixed setpoint?
 21 A Yes.
 22 Q And is it your testimony that you stayed at a
 23 fixed setpoint from then until the switch to inlet
 24 temperature in about 1995 or 1996?
 25 A Was that a question?

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1 Q Yes, sir.
 2 A Can you repeat?
 3 Q And the question part of it was, you stayed
 4 continuously with a fixed point between when you
 5 switched to it, which is what you say was mid to late
 6 1990s, to a setpoint based on inlet temperature, which I
 7 believe you said earlier was '95 or '96?

8 A Yes.
 9 Q Now, you said earlier something to the effect
 10 of you had concluded that the delta P over P was not a
 11 function of inlet guide vane angle, and that's why you
 12 didn't use it anymore. Do you remember that general
 13 testimony?

14 A Yes.

15 Q Is it your testimony that there is some
 16 absolute sense in which the delta P over P measure by
 17 the 3200 does not correlate to the inlet guide vane
 18 angle?

19 MR. McCACKEN: Objection; vague.

20 THE WITNESS: Can you repeat the question?
 21 (Record read.)

22 THE WITNESS: I don't understand the question.
 23 Absolute sense?

24 BY MR. PUTNAM:

25 Q What do you mean by the statement, "The delta P

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1 over P measure by the 3200 was not a function of inlet
 2 guide vane position?

3 A That we had a relationship provided by
 4 Turbomeca which showed delta P on P versus flow, which
 5 applied for IGV full open and applied exactly the same
 6 relationship for IGV full closed. That defines the
 7 delta P on P versus flow relationship was independent of
 8 IGV angle.

9 Q And that's based on data that was supplied to
 10 you by Turbomeca?

11 A Yes.

12 Q Do you recall the circumstances under which
 13 Turbomeca supplied that data to you?

14 A There was a coordination memo.

15 Q Do you know where Turbomeca got that data to
 16 supply to you?

17 A I do not know.

18 Q Do you have any understanding as to where they
 19 got that data?

20 A I understood they did a lot of testing and
 21 empirical development themselves to develop that
 22 relationship and design the geometry of the load
 23 compressor system to ensure that relationship did, in
 24 fact, hold true.

25 Q When you say "that relationship," what

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1 relationship --
 2 A The delta P on P versus flow which was
 3 independent of IGV angle.
 4 Q When you say you understood that they did a lot
 5 of testing, what's the basis for that testimony?
 6 A Discussions I had with Turbomeca engineers that
 7 indicated the criticality of the work and the length of
 8 time that it had taken to develop this.
 9 Q What Turbomeca engineers do you remember
 10 discussing this topic with?
 11 A Hebert Vignau, H-e-b-i-e-r-t V-i-g-n-a-u.
 12 Q Anyone else?
 13 A That's all I recall talking to.
 14 Q Have you heard of an APU called the Jazz 39?
 15 A Yes.
 16 Q Is that an APU?
 17 MR. McCACKEN: Standing objection as to
 18 questions regarding the Jazz 39, relevance.
 19 BY MR. PUTNAM:
 20 Q Is that an APU made by Sundstrand?
 21 A Yes.
 22 Q Can you give -- well, let me ask you this:
 23 Does the Jazz 39 have adjustable inlet guide vanes?
 24 A Yes.
 25 Q Can you provide any testimony about the

1 operation of the surge control system in the Jazz 39?
 2 A No.
 3 Q Can you provide any testimony about operation
 4 of the fuel start-up control system in the Jazz 39?
 5 A No.
 6 Q Who -- if you wanted to know about either of
 7 those control systems for the Jazz 39, who would you go
 8 talk to?

9 A Paul Hilgeman.
 10 Q And who is that?
 11 A Systems engineer at Sundstrand.

12 Q I asked you last time about an individual named
 13 Terry Maedche; do you remember that name?

14 A Yes.
 15 Q Can you tell me the contributions made by Terry
 16 Maedche to the development of the APS 3200?

17 A He worked with us for a relatively short
 18 period. I believe he started working with us in late
 19 1992. But I don't recall exactly. He was a systems
 20 engineer on the 3200 team for a while. He went to
 21 flight test, which started in May of 1993. He was
 22 stationed in Toulouse supporting our flight test for us
 23 for a period of three or four months. I don't recall
 24 exactly when he came back, he was laid off relatively
 25 shortly after that.

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1 Q When you say flight test in Toulouse, that was
2 actual flight testing of the APS 3200?
3 A In Airbus aircraft, yes.
4 Q What were the circumstances of him being laid
5 off?
6 A I wasn't involved.
7 Q Do you have any understanding of why he was
8 laid off?
9 A He was an employee who didn't fit in well with
10 the team. There was a reduction in force in the
11 aerospace industry in general in that time and he was
12 surplus to requirements.
13 Q In what sense did he not fit in well with the
14 team?
15 A He believed he should be a lead engineer, when
16 he had not worked with us long enough to prove his
17 ability.
18 Q During the period of time when he was a systems
19 engineer on the APS 3200 between, I think you said, late
20 1992 and approximately May, 1993, what were his duties
21 and responsibilities?
22 A General support of the system development.
23 Q And when you say system development, you mean
24 the development of the APS 3200?
25 A Control system, yes.

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1 Q And in that position did Mr. Crooks have
2 responsibility for, among other things, the surge
3 control valve?
4 A Not the valve itself, no.
5 Q The control system?
6 A Control system, yes.
7 Q Let me restate the question, then. Am I right
8 that when Mr. Crooks became the systems engineer for the
9 APS 3200 he had responsibility for the surge control
10 system for the APS 3200?
11 A We were not making any changes to the surge
12 control system. So he was a systems engineer
13 responsible for all of the system, but there were no
14 changes being made to the surge control system at that
15 time.
16 Q That wasn't my question. My question is, am I
17 correct that Mr. Crooks was responsible as the system
18 engineer for the surge control system?
19 A Yes.
20 Q Was Mr. Crooks also responsible as the system
21 engineer for the fuel control start-up system?
22 MR. McCACKEN: Objection; vague.
23 THE WITNESS: Yes.
24 BY MR. PUTNAM:
25 Q For how long did Mr. Crooks serve as systems

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1 Q And when he worked as a flight test engineer in
2 France during 1993, what were his duties and
3 responsibilities for the APS 3200?
4 A To represent Sundstrand at the flight test, to
5 review data as it came from Airbus, to try and
6 troubleshoot problems quickly. Because of the time
7 difference to Europe, you don't have somebody on site,
8 it can leave problems for a long time before somebody
9 starts to work on them. A liaison.
10 Q What role did Branch Crooks play in the design
11 and development of the APS 3200?
12 A Branch joined the team later. I would -- I
13 believe 1994. He was a support systems engineer to Ed
14 Edelman in the early days. When Ed left, Branch was the
15 systems engineer of the program. The system's already
16 designed by that time, and the work load was
17 significantly lower.
18 Q And is Mr. Crooks still at Sundstrand?
19 A I'm not exactly sure. He retired and came back
20 on some type of contract. But I don't know if he is
21 currently associated with Sundstrand or not.
22 Q And what were his -- am I right that at some
23 point Mr. Crooks became the systems engineer for the
24 APS 3200?
25 A Yeah.

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1 engineer for the APS 3200?
2 A I don't recall exactly. Until the introduction
3 of version 4.1, at which point the system's effort went
4 to zero.
5 Q And when was that, approximately?
6 A Late '96.
7 Q All right. Is it fair to say that Mr. Crooks
8 was the systems engineer for the APS 3200 for
9 approximately two years?
10 A No. Initially he was support to Ed Edelman.
11 Only when Ed Edelman left did Branch Crooks take that
12 function.
13 Q For what period of time was Mr. Crooks the
14 system engineer for the APS 3200?
15 A I don't recall exactly when Ed Edelman left.
16 Q What did you mean when you said in an earlier
17 answer after the introduction of version 4.1 the
18 system's effort went to zero?
19 A Once a new version of software enters service,
20 there's no more development work for a while. There's
21 time to see how that version of software functions in
22 service. At that time there's no more design efforts,
23 systems design effort ongoing. It picks up later, when
24 John Szillat, we decided we needed another version of
25 software. We decided to do a design effort again.

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1 Q So is it fair to say that Mr. Crooks had the
2 job that Mr. Szillat has now?

3 A Yes.

4 Q And Mr. Crooks was the design engineer leading
5 up to the release of version 4.1 of the APS 3200 control
6 software; right?

7 A Yes.

8 Q And am I correct that in contrast to the time
9 after the release of that software, during the time
10 leading up to the release of that software, Mr. Crooks
11 would have had active responsibility in overseeing the
12 design and potential redesign of control software?

13 A Could you repeat it, please?

14 (Record read.)

15 MR. McCACKEN: Objection; vague.

16 THE WITNESS: Yes.

17 BY MR. PUTNAM:

18 Q Did Mr. Crooks retire after the release of
19 version 4.1? Or did he move on to some other position
20 within Sundstrand?

21 A He moved on to other positions.

22 Q Were they connected to the APS 3200?

23 A No.

24 Q Since the release of version 4.1, to your
25 knowledge, has Mr. Crooks had any responsibility, either

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1 A There are no major changes.

2 Q Are there any other changes of any sort that
3 you can specifically identify as you sit here?

4 A None that I can state as I sit here.

5 Q Are there any changes to the fuel control
6 start-up system contemplated as part of version 5 of the
7 3200 software?

8 A Yes.

9 Q What are those?

10 A The term "fuel control start-up" is very broad.
11 There is -- prior to the APU actually lighting off, we
12 have what's called an open loop schedule. We're making
13 a minor change to that open loop schedule.

14 Q What do you mean by an open loop schedule?

15 A I mean an amount of fuel input to the APU as a
16 function of speed. That is a function of what we call
17 manifold fill, which is the intention of filling the
18 fuel control lines with fuel prior to igniting the APU.

19 Q And what is the change that's being made to
20 that open loop schedule?

21 A An increase of amount of fuel that's measured
22 in pounds per hour. I don't recall exactly the numbers.

23 Q Are there any other changes that are being
24 contemplated to the fuel control start-up system as part
25 of version 5?

1 A Not that I recall.

2 Q I think you identified last time an individual
3 named Bernard Macarez. Do you remember that name?

4 A Yes.

5 Q Am I right that he was a Turbomeca employee who
6 worked on the APS 3200?

7 A Yes.

8 Q And what were his duties and responsibilities
9 with regard to the 3200?

10 A He was a liaison engineer, stationed in
11 San Diego, with the intention of making the partnership
12 work more seamlessly.

13 Q For how long did he play that role?

14 A I don't recall.

15 Q Several years?

16 A Probably 18 months. It wasn't that long.

17 Q What did he do after he -- the end of those 18
18 months?

19 A He went back to Turbomeca.

20 Q Did he continue to work on the APS 3200?

21 A No.

22 Q Can you identify the contributions made by
23 Mr. Macarez to the design and development of the APS
24 3200?

25 A No.

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31 (Pages 312 to 315)

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1 (Deposition Exhibit 49 marked.)

2 BY MR. PUTNAM:

3 Q Mr. Suttie, let me hand what you the court
4 reporter has marked as Suttie Deposition 49, which is an
5 April 4th, 1993 memo from Ed Edelman, with production
6 numbers HSA 351515 through HSA 351519. Do you have that
7 document in front of you?

8 A Yes.

9 Q If you turn -- first of all, can you tell me
10 what this document is, please?

11 A It appears to be a document defining the
12 differences between the interface control document we
13 discussed earlier and the then-software version 1.0.1,
14 which was a flight test.

15 Q When you say "software version 1.0.1, which was
16 a flight test," what do you mean?

17 A It never entered service. It was an Airbus for
18 flight test.

19 Q "It" being that version of the software;
20 correct?

21 A "It" being that version of the software.

22 Q If you turn to page HSA 351518, do you see a
23 chart labeled "load compressor surge control"?

24 A Yes.

25 Q And am I right that this is a version of the

1 there's a box that's labeled "latch"?

2 A Yes.

3 Q What is the -- how is that latch operating as
4 part of the surge control system depicted here?

5 A You need to work back through the logic diagram
6 to see how the latch is set and what causes it to be
7 reset through the "or" and "and" gates.

8 Q And what is it that causes it to be set or
9 reset.

10 A There's a parameter, DELPQP, as it's referred
11 to here, which is delta P on P. I need to go and find
12 exactly what that -- on these sheets exactly how that's
13 determined. As I remember, it's the point 35. As long
14 as delta P on P is above point 35, this latch would be
15 set. Additionally, there's the computation of B factor.

16 There are many limit values which are in
17 circular boxes with shading, BCVH -- I can't read that.
18 But any of these boxes that limits our threshold. And
19 there's the determination of B critical mentioned in the
20 table, that causes that latch to be set or un -- reset.

21 Q How does the latch affect the rest of the
22 operation of the surge control system in this diagram?

23 A Without working back in detail through it,
24 either a 1 or a 0 out of the latch, I'm not exactly
25 sure, causes the value LDOES to pass through to the

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1 surge control system for the APS 3200 that utilized the
2 B factor and the B critical setpoint?

3 A Can you repeat the question?

(Record read.)

THE WITNESS: Yes.

6 BY MR. PUTNAM:

7 Q Is this an accurate depiction of the surge
8 control system that was used by the APS 3200 when it
9 first went into actual operation in January, 1994?

10 A I don't recall.

11 Q Do you see there's a chart with two columns, in
12 the lower right quadrant of the page, which has one
13 column headed IGV and one column headed BC?

14 A I do.

15 Q What is that chart depicting?

16 A The B critical value -- B critical value
17 changed as a function of IGV.

18 Q And do you see immediately to the left of that
19 there's a dotted line that connects two different parts
20 of the control diagram together?

21 A Yes.

22 Q Is that dotted line connected somehow to the
23 relationship between B critical and IGV?

24 A No.

25 Q Do you see at the bottom of the dotted line

1 bleed control value, or the value LDOES to be ignored
2 and the bleed valve to be put to the position KSRGMX.

3 Q And am I right in this diagram that the value
4 LDOES, if you trace that back, that is a function of the
5 proportional and integral control of delta P over P?

6 MR. McCACKEN: Objection; vague.

7 THE WITNESS: Not necessarily. As you can see,
8 there are many -- there are other paths that could cause
9 LDOES to be a different value.

10 BY MR. PUTNAM:

11 Q Am I right that LDOES in this diagram can be,
12 among other things, a function of delta P over P as
13 proportionally and integrally controlled?

14 MR. McCACKEN: Objection; vague.

15 THE WITNESS: Not delta P over P proportionally
16 and integrally controlled.

17 BY MR. PUTNAM:

18 Q I'm sorry?

19 A No.

20 Q Why not?

21 A Because it's not delta P over P that's
22 proportionally and integrally controlled. It's the
23 difference.

24 Q Okay. Am I right that LDOES in this diagram
25 can be, among other variabilities, a function of the

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1 proportional and integral control of the difference
2 between the measured and setpoint values of delta P over
3 P?

4 MR. McCACKEN: Objection; vague.

5 THE WITNESS: We discussed last time there's a
6 differential term, so it's proportional plus integral
7 plus differential control.

8 BY MR. PUTNAM:

9 Q Okay. Am I right that ~~LDPES~~ in this diagram
10 can be, among other variables, a function of the
11 proportional integral and derivative control of the
12 difference between the measured and setpoint values of
13 delta P over P?

14 MR. McCACKEN: Objection; vague.

15 THE WITNESS: Yes.

16 MR. PUTNAM: Let's take a short break. We're
17 at a turning point.

18 MR. McCACKEN: Okay.

19 (Recess.)

20 (Deposition Exhibit 50 marked.)

21 BY MR. PUTNAM:

22 Q Mr. Suttie, let me hand what you the court
23 reporter has marked as Suttie Deposition Number 50,
24 which is labeled, "APS 200 design verification" and has
25 production numbers HSA 455702 through HSA 455761.

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1 Can you tell me whether you recognize that
2 document, sir?

3 A I don't recall it offhand.

4 Q If you turn to the third page of the document,
5 which is labeled HSA 455704. Do you see that you're
6 listed as receiving a copy of this document?

7 A Yes.

8 Q Are you familiar in general with a type of
9 document inside Sundstrand referred to as a design
10 verification document?

11 A Yes.

12 Q And what would be the purpose of a design
13 verification document?

14 A Normally a verification document is intended to
15 show that a product or system as implemented meets the
16 requirements that would be specified previously.

17 Q Is this a design verification document for the
18 APS 3200?

19 A Yes.

20 Q Can you turn, please, to Figure 1.2, which is
21 on page 19? And may be folded over, because it's
22 actually an oversize page, at least as it was produced
23 to us.

24 A Can you repeat that, please?

25 Q Sure. I want you to turn to page 19 HSA 455726

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1 in Suttie Exhibit 50.

2 A Okay.

3 Q You have that document in front of you?

4 A Pages 19.

5 Q And it's labeled at the bottom, "Figure 1.2:
6 APS 3200 control logic."

7 A Yes.

8 Q Can you tell me what this depicts generally?

9 A Generally it's the control algorithms included
10 in the ECB.

11 Q The control algorithms for the 3200 electronic
12 control box?

13 A Yes.

14 Q Am I right that the top portion of the page
15 relates to the start-up fuel control system for the APS
16 3200?

17 A Yes.

18 Q Now, on the top left of the top box, do you see
19 that there are two inputs being picked up there? One is
20 called PERSPD and one is called TIME. Do you see that?

21 A Yes.

22 Q Can you tell me what PERSPD means?

23 A Short for percent speed.

24 Q And what is it that's being measured there as
25 part of the APS 3200 fuel control start-up system?

1 A Speed.

2 Q And what is TIME? Is that just time?

3 A I assume so, yes.

4 Q And in the fuel control start-up system for the
5 APS 3200, as depicted here, what does the system do with
6 the measurement of percent speed and the measurement of
7 time?

8 A Nothing.

9 Q Why are those values being shown as being
10 measured and then combined in some way?

11 A Well, they're not. Time stops being time when
12 it goes into that box.

13 Q What happens in that box?

14 A There appears to be a look-up table. The axes
15 are not identified.

16 Q And do you see there's summing junction that's
17 a circle maybe an inch to the right of where it says
18 PERSPD?

19 A To the right of PERSPD?

20 Q Right. Yes, there's a summing junction that
21 says -- or there's a summary junction; do you see that?

22 A Yes.

23 Q And the value coming out of that ER1SPD; do see
24 that?

25 A Yes.

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1 Q What does ER1SPD stand for?
2 A Error, speed error.
3 Q Am I right that in the APS 3200 fuel control
4 engine, engine start-up fuel control system, the APU
5 measures percent speed, measures time, and then
6 generates an error speed figure?
7 A No, you're not correct.
8 Q What was wrong with that statement?
9 A What is depicted here is not what is depicted
10 in the APS 3200 systems requirement specification. And
11 APS 3200 does not use time to generate a speed for -- to
12 be summed with the actual speed.
13 Q Well, am I right that at least as of the time
14 that this document was created in March, 1992, it was
15 contemplated that the APS 3200 would measure time as
16 part of the fuel control engine start-up logic?
17 A I don't believe so. I think if you look at the
18 dates of previous system specs, you'll find that this
19 is, in fact, in error.
20 Q When you say this is an error, what do you
21 mean?
22 A The fact that this implies time was generating
23 a speed value. As I mentioned during my last
24 deposition, it fundamentally can't work this way,
25 because different engines accelerate at a different

1 acceleration; correct?
2 A Correct.
3 Q And acceleration is the change in speed over
4 time; correct?
5 A It is the change in speed over the change in
6 time.
7 Q What do you mean by that?
8 A It's like delta speed divided by delta time.
9 Q So acceleration, as used by the APS 3200 fuel
10 control start-up system, is the change in speed of the
11 engine for a given interval of time; correct?
12 A Yes.
13 Q Am I correct that in order to measure
14 acceleration, the APS 3200 fuel control start-up system
15 needs to measure the speed at the start of an interval,
16 the speed at the end of the interval, and the time
17 elapsed during the interval?
18 MR. McCACKEN: Objection; vague.
19 THE WITNESS: What do you mean by time elapsed
20 during the interval?
21 BY MR. PUTNAM:
22 Q The length of the interval.
23 A Yes.
24 Q Am I correct that the APS 3200 fuel control
25 start-up system could not measure acceleration if it did

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1 rate. And so time is not a valuable function. You need
2 to look at speed alone. Because if an engine
3 accelerates slowly, a time-based algorithm can't
4 function.
5 Q Okay. When you say different engines
6 accelerate at different rates, do you mean different
7 APS 3200s will accelerate at different rates?
8 A Yes.
9 Q Why is that?
10 A Energy to the starter motor may be different.
11 The ambient temperature may be different. Humidity.
12 Many factors. Engine may be old. It may have greater
13 wear bearings. There are a multitude of reasons which
14 would cause an APU to accelerate at a different rate.
15 Q The fact, as you say, the different APS 3200s
16 accelerate at different rates, is that unique to the
17 APS 3200, or is it your contention that that would be
18 true of any type of APU?
19 A Any type of APU.
20 Q So is it your belief that an algorithm based on
21 time would not be an appropriate way to control the fuel
22 start-up logic for any APU?
23 A It's not a reliable way.
24 Q And as I understand your testimony, the
25 APS 3200, rather than being based on time, is based on

1 not know the length of the interval that separated the
2 two speed measurements?
3 A Correct.
4 Q In the APS 3200 fuel control start-up system,
5 am I right that the system increases fuel flow as a
6 function of the sensed acceleration?
7 A Can you define what you mean by function?
8 Q Am I right in the APS 3200 fuel control
9 start-up system, that fuel flow is scheduled based on
10 sensed acceleration?
11 A No.
12 Q Okay. What's the relationship between
13 acceleration and fuel flow in the APS 3200 fuel control
14 start-up system?
15 A The control system has a desired rate of
16 acceleration for the APU. The measured acceleration
17 we've just discussed, compared with the desired
18 acceleration, the error's computed, that error is fed
19 towards the fuel control; however, it need not control
20 fuel, because similarly EGT is measured, and the EGT
21 maximums, and so whichever of those two loops is
22 commanding the lower fuel flow will be the loop which
23 maintains control of the fuel control servo.
24 Q When you say fuel control servo, what do you
25 mean by servo?

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1 A Servo is the actuator that actually varies the
2 amount of fuel flow going into the APU.
3 Q So as I understand your testimony, in the APS
4 3200 fuel control start-up system, the difference
5 between the measured acceleration and the desired
6 acceleration can affect the fuel flow to the engine, but
7 it might not depending on certain other variables at
8 that time; correct?
9 A Correct.
10 Q Does the APS 3200 fuel control start-up system
11 have a schedule of the rate of fuel flow in relation to
12 the speed of the engine?
13 A No.
14 Q Does it have a schedule of the rate of fuel
15 flow in relation to the acceleration of the engine?
16 A No.
17 Q Does the APS 3200 fuel control start-up system
18 produce an error signal when the fuel flow rate gets to
19 be too high?
20 A No.
21 Q I've seen references in some documents to
22 minimum fuel -- minimum flow rate and maximum flow rate.
23 Are you familiar with those terms?
24 A Yes.
25 Q How are minimum and maximum flow rates used in

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1 extension occurring, which is when the combustor starts
2 burning because too much fuel was inserted into the
3 combustor.
4 Q And at that point the maximum fuel limit in the
5 APS 3200 operates to limit fuel flow to the engine;
6 correct?
7 A Yes.
8 Q Am I right in the APS 3200 engine start-up fuel
9 control system, the rate of fuel flow to the engine is
10 increased in relation to the rate of acceleration?
11 MR. McCACKEN: Objection; ambiguous and vague.
12 THE WITNESS: Can you repeat, please?
13 (Record read.)
14 THE WITNESS: Not necessarily.
15 BY MR. PUTNAM:
16 Q Okay. Am I right that in the APS 3200 engine
17 start-up fuel control system, the rate of fuel flow to
18 the engine is under certain conditions increased in
19 relation to the rate of acceleration?
20 MR. McCACKEN: Objection; ambiguous and vague.
21 THE WITNESS: Can you -- define what you mean
22 by "in relation to." I'm not understanding the
23 question.
24 BY MR. PUTNAM:
25 Q Am I right that in the APS 3200 system start-up

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1 the APS 3200 start-up fuel control system?
2 A They are limits which will prevent -- the
3 maximum fuel limit, will prevent a maximum -- it's a
4 maximum amount of fuel that the engine could tolerate at
5 that -- for that speed. It doesn't mean it's followed.
6 And typically it's not.
7 Q What do you mean, "It doesn't mean it's
8 followed?"
9 A The purpose of a control algorithm is to
10 schedule -- schedule is a bad word. Purpose of the
11 control algorithm is to put into the APU the correct
12 amount of fuel to maintain the acceleration or to
13 prevent over-temperature. That value is not -- the
14 actual value of that time is not particularly important.
15 What's important is maintaining the acceleration, or
16 maintaining an exhaust gas temperature. We don't
17 measure fuel flow. We can't schedule to a fuel flow,
18 because we don't actually know what it is. We can only
19 compute what we think it might be.
20 Q Am I right that the system in the APS 3200
21 operates to limit fuel flow if the maximum fuel limit is
22 exceeded?
23 A Yes. The maximum fuel limit is intended to
24 indicate a point at which the combustor could not take
25 any more fuel without a phenomenon known as rich

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1 fuel control system, the rate of fuel flow to the engine
2 is under certain conditions increased as a function of
3 the rate of acceleration?
4 MR. McCACKEN: Objection; ambiguous and vague.
5 THE WITNESS: Not necessarily increased.
6 BY MR. PUTNAM:
7 Q What do you mean by that?
8 A I believe if the acceleration rate is too fast,
9 we would actually cut back on fuel.
10 Q There is a relationship between the rate of
11 fuel flow and the rate of acceleration in the APS 3200;
12 correct?
13 A When you say rate of fuel flow, you mean with
14 respect to what?
15 Q The amount of fuel that's flowing into the
16 engine.
17 A The amount of fuel flowing into the engine at
18 any given time?
19 Q Yes.
20 A Then there is not a relationship between that
21 and acceleration.
22 Q What is there a relationship between, then?
23 MR. McCACKEN: Objection; vague.
24 THE WITNESS: What is there a relationship
25 between, what and what?

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35 (Pages 328 to 331)

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1 BY MR. PUTNAM:

2 Q Let me ask the question this way, Mr. Suttie:
3 Describe for me the role that acceleration plays in the
4 APS 3200 engine start-up fuel control system.5 A The ECB has a desired rate of acceleration,
6 which is designed to have a smooth and progressive start
7 of the APU. That is included in a look-up table in the
8 ECB specification. Actual acceleration, which as I
9 mentioned earlier can vary for many reasons, is compared
10 with the desired rate of acceleration. And depending on
11 the difference between those two numbers, in certain
12 circumstances, when EGT is far from the EGT limit, the
13 delta between acceleration required and acceleration
14 measured will have caused the servo current to change.
15 Servo is, as I mentioned, the actuation device on the
16 fuel control. So by servo current changing, in most
17 cases the fuel flow will change, either up or down,
18 depending on its command.19 Q Okay. Thank you. That's helpful. Have you
20 been involved in any analysis -- let me ask this
21 question first: Have you ever read the three Allied
22 Signal or Honeywell patents that are at issue in this
23 case?

24 A Yes.

25 Q Have you read all three of them?

1 the witness subject to the occurrence of the subjects I
2 mentioned just above. Thank you.

3 MR. McCACKEN: The record is complete.

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10 I, PETER J. SUTTIE, do hereby declare under
11 penalty of perjury that I have read the foregoing
12 transcript; that I have made such corrections as noted
13 herein, in ink, initialed by me, or attached hereto;
14 that my testimony as contained herein, as corrected, is
15 true and correct.16 EXECUTED this _____ day of _____
17 2000, at _____

(city)

(state)

18

19 PETER J. SUTTIE
20
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335

36 (Pages 332 to 335)

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HONEYWELL INTERNATIONAL V.
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PETER J. SUTTIE
06/29/00

1 STATE OF CALIFORNIA)
2 : ss
3 COUNTY OF SAN DIEGO)

4 I, the undersigned, a Certified Shorthand
5 Reporter of the State of California, do hereby certify:
6 That the foregoing proceedings were taken
7 before me at the time and place herein set forth; that
8 any witnesses in the foregoing proceedings, prior to
9 testifying, were placed under oath; that a verbatim
10 record of the proceedings was made by me using machine
11 shorthand which was thereafter transcribed under my
12 direction; further, that the foregoing is an accurate
13 transcription thereof.

14 I further certify that I am neither financially
15 interested in the action nor a relative or employee of
16 any attorney of any of the parties.

17 IN WITNESS WHEREOF, I have this date subscribed
18 my name.

19
20 Dated: _____

21
22
23
24 RENEE KELCH
25 CSR No. 5063

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06/29/00

1 A I'm not aware of any.
 2 MR. PUTNAM: And for the record, the court
 3 reporter has been doing a great job, so I'm sure it's my
 4 mistake.
 5 MR. MCCRACKEN: We didn't presume otherwise.
 6 (Deposition Exhibit 47 marked.)
 7 BY MR. PUTNAM:
 8 Q Mr. Suttie, let me hand you what's been marked
 9 as Suttie Exhibit Number 47, which is a one-page
 10 document with production number HSB 215483, and ask if
 11 you recognize this document?
 12 A I don't recall it. I recognize it, but I don't
 13 recall it.
 14 Q Do you see that it's a memo from Mr. Hardy
 15 dated December, 1992?
 16 A Yes.
 17 Q And do you see that in the bottom middle of the
 18 page you're one of the individuals to whom it was
 19 distributed at Sundstrand?
 20 A Yes.
 21 Q Do you see in the middle page, Mr. Hardy says,
 22 "It appears necessary to use a delta P over P setpoint
 23 function of IGV setting angle"?
 24 A I do.
 25 Q Do you know why it is that Mr. Hardy reached

300

1 that conclusion?
 2 A No.
 3 Q Do you see in the bottom middle of the
 4 document, where the box that says "distribution to SPS,"
 5 someone has written in handwriting, "Assigned Suttie"?
 6 A Yes.
 7 Q First of all, do you know whose handwriting
 8 that is?
 9 A Yes.
 10 Q And whose is it?
 11 A Steve Gates.
 12 Q And he was your boss at the time?
 13 A Yes.
 14 Q Do you remember being assigned by Mr. Gates to
 15 respond to Mr. Hardy's conclusion that it was necessary
 16 to use delta P over P setpoint function of inlet guide
 17 vane angle?
 18 A I don't recall.
 19 (Deposition Exhibit 48 marked.)
 20 BY MR. PUTNAM:
 21 Q Mr. Suttie, let me hand what you the court
 22 reporter has marked as Suttie Deposition Exhibit
 23 Number 48, which is a two-page memo, dated January,
 24 1993, production numbers HSB 215481 and 482.
 25 Do you have that document in front of you?

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1 A Yes.
 2 Q And you see again in the bottom middle of the
 3 page someone has assigned you, Mr. Hardy -- I'm sorry,
 4 Mr. Gates has assigned you to respond to this document?
 5 A Yes.
 6 Q This is from a Mr. Biscay; do you see that?
 7 A Yes.
 8 Q Who is that?
 9 A Aerodynamics engineer at Turbomeca.
 10 Q If you turn to the second page of the document,
 11 you see a heading that says, "Relation delta P over P
 12 versus IGV actuator position"?
 13 A I do.
 14 Q What is the import of what's set out at that
 15 part of the document?
 16 MR. MCCRACKEN: Objection; vague.
 17 THE WITNESS: What do you mean by the import?
 18 BY MR. PUTNAM:
 19 Q What's he talking about?
 20 A Appears to be making a proposal to make the
 21 delta P over P setpoint a function of some numbers. And
 22 then a value X.
 23 Q What does the X stand for there?
 24 A It says "X in percent" above. Previously it
 25 says, "Let X be the IGV actuator position in percent."

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1 Q Now, this document is dated January, 1993. Do
 2 you know when it was that Sundstrand decided not to use
 3 IGV position to establish the delta P over P setpoint?
 4 A Approximately the year 1990.
 5 Q My question was decided not to use. Did you
 6 hear that?
 7 A Decided not to use IGV.
 8 Q Yes.
 9 A The proposal we discussed already in 1989
 10 showed IGV. By mid 1990 or the end of 1990 we decided
 11 not to use IGVs and never again used IGVs in any of our
 12 documentation or thought processes.
 13 Q Okay. And my question, then, is what's the
 14 explanation of both Exhibits 47 and 48 from December,
 15 '92 and January, '93 that show at least Turbomeca saying
 16 we need to use IGV position for the setpoint?
 17 A I don't know. We never did it.
 18 Q As of mid or the end 1990, when you say you
 19 decided not to use IGVs, at that point did you go to a
 20 fixed setpoint?
 21 A Yes.
 22 Q And is it your testimony that you stayed at a
 23 fixed setpoint from then until the switch to inlet
 24 temperature in about 1995 or 1996?
 25 A Was that a question?

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1 Q Yes, sir.
 2 A Can you repeat?
 3 Q And the question part of it was, you stayed
 4 continuously with a fixed point between when you
 5 switched to it, which is what you say was mid to late
 6 1990s, to a setpoint based on inlet temperature, which I
 7 believe you said earlier was '95 or '96?

8 A Yes.
 9 Q Now, you said earlier something to the effect
 10 of you had concluded that the delta P over P was not a
 11 function of inlet guide vane angle, and that's why you
 12 didn't use it anymore. Do you remember that general
 13 testimony?

14 A Yes.

15 Q Is it your testimony that there is some
 16 absolute sense in which the delta P over P measure by
 17 the 3200 does not correlate to the inlet guide vane
 18 angle?

19 MR. McCACKEN: Objection; vague.

20 THE WITNESS: Can you repeat the question?
 (Record read.)

21 THE WITNESS: I don't understand the question.
 22 Absolute sense?

23 BY MR. PUTNAM:

24 Q What do you mean by the statement, "The delta P

304

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1 over P measure by the 3200 was not a function of inlet
 2 guide vane position?

3 A That we had a relationship provided by
 4 Turbomeca which showed delta P on P versus flow, which
 5 applied for IGV full open and applied exactly the same
 6 relationship for IGV full closed. That defines the
 7 delta P on P versus flow relationship was independent of
 8 IGV angle.

9 Q And that's based on data that was supplied to
 10 you by Turbomeca?

11 A Yes.

12 Q Do you recall the circumstances under which
 13 Turbomeca supplied that data to you?

14 A There was a coordination memo.

15 Q Do you know where Turbomeca got that data to
 16 supply to you?

17 A I do not know.

18 Q Do you have any understanding as to where they
 19 got that data?

20 A I understood they did a lot of testing and
 21 empirical development themselves to develop that
 22 relationship and design the geometry of the load
 23 compressor system to ensure that relationship did, in
 24 fact, hold true.

25 Q When you say "that relationship," what

305

307

1 relationship --
 2 A The delta P on P versus flow which was
 3 independent of IGV angle.
 4 Q When you say you understood that they did a lot
 5 of testing, what's the basis for that testimony?
 6 A Discussions I had with Turbomeca engineers that
 7 indicated the criticality of the work and the length of
 8 time that it had taken to develop this.
 9 Q What Turbomeca engineers do you remember
 10 discussing this topic with?

11 A Hebert Vignau, H-e-b-e-r-t V-i-g-n-a-u.
 12 Q Anyone else?

13 A That's all I recall talking to.

14 Q Have you heard of an APU called the Jazz 39?

15 A Yes.

16 Q Is that an APU?

17 MR. McCACKEN: Standing objection as to
 18 questions regarding the Jazz 39, relevance.

19 BY MR. PUTNAM:

20 Q Is that an APU made by Sundstrand?

21 A Yes.

22 Q Can you give -- well, let me ask you this:
 23 Does the Jazz 39 have adjustable inlet guide vanes?

24 A Yes.

25 Q Can you provide any testimony about the

1 operation of the surge control system in the Jazz 39?

2 A No.

3 Q Can you provide any testimony about operation
 4 of the fuel start-up control system in the Jazz 39?

5 A No.

6 Q Who -- if you wanted to know about either of
 7 those control systems for the Jazz 39, who would you go
 8 talk to?

9 A Paul Hilgeman.

10 Q And who is that?

11 A Systems engineer at Sundstrand.

12 Q I asked you last time about an individual named
 13 Terry Maedche; do you remember that name?

14 A Yes.

15 Q Can you tell me the contributions made by Terry
 16 Maedche to the development of the APS 3200?

17 A He worked with us for a relatively short
 18 period. I believe he started working with us in late
 19 1992. But I don't recall exactly. He was a systems
 20 engineer on the 3200 team for a while. He went to
 21 flight test, which started in May of 1993. He was
 22 stationed in Toulouse supporting our flight test for us
 23 for a period of three or four months. I don't recall
 24 exactly when he came back, he was laid off relatively
 25 shortly after that.

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1 Q When you say flight test in Toulouse, that was
2 actual flight testing of the APS 3200?
3 A In Airbus aircraft, yes.
4 Q What were the circumstances of him being laid
5 off?
6 A I wasn't involved.
7 Q Do you have any understanding of why he was
8 laid off?
9 A He was an employee who didn't fit in well with
10 the team. There was a reduction in force in the
11 aerospace industry in general in that time and he was
12 surplus to requirements.
13 Q In what sense did he not fit in well with the
14 team?
15 A He believed he should be a lead engineer, when
16 he had not worked with us long enough to prove his
17 ability.
18 Q During the period of time when he was a systems
19 engineer on the APS 3200 between, I think you said, late
20 1992 and approximately May, 1993, what were his duties
21 and responsibilities?
22 A General support of the system development.
23 Q And when you say system development, you mean
24 the development of the APS 3200?
25 A Control system, yes.

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1 Q And in that position did Mr. Crooks have
2 responsibility for, among other things, the surge
3 control valve?
4 A Not the valve itself, no.
5 Q The control system?
6 A Control system, yes.
7 Q Let me restate the question, then. Am I right
8 that when Mr. Crooks became the systems engineer for the
9 APS 3200 he had responsibility for the surge control
10 system for the APS 3200?
11 A We were not making any changes to the surge
12 control system. So he was a systems engineer
13 responsible for all of the system, but there were no
14 changes being made to the surge control system at that
15 time.
16 Q That wasn't my question. My question is, am I
17 correct that Mr. Crooks was responsible as the system
18 engineer for the surge control system?
19 A Yes.
20 Q Was Mr. Crooks also responsible as the system
21 engineer for the fuel control start-up system?
22 MR. McCACKEN: Objection; vague.
23 THE WITNESS: Yes.
24 BY MR. PUTNAM:
25 Q For how long did Mr. Crooks serve as systems

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1 Q And when he worked as a flight test engineer in
2 France during 1993, what were his duties and
3 responsibilities for the APS 3200?
4 A To represent Sundstrand at the flight test, to
5 review data as it came from Airbus, to try and
6 troubleshoot problems quickly. Because of the time
7 difference to Europe, you don't have somebody on site,
8 it can leave problems for a long time before somebody
9 starts to work on them. A liaison.
10 Q What role did Branch Crooks play in the design
11 and development of the APS 3200?
12 A Branch joined the team later. I would -- I
13 believe 1994. He was a support systems engineer to Ed
14 Edelman in the early days. When Ed left, Branch was the
15 systems engineer of the program. The system's already
16 designed by that time, and the work load was
17 significantly lower.
18 Q And is Mr. Crooks still at Sundstrand?
19 A I'm not exactly sure. He retired and came back
20 on some type of contract. But I don't know if he is
21 currently associated with Sundstrand or not.
22 Q And what were his -- am I right that at some
23 point Mr. Crooks became the systems engineer for the
24 APS 3200?
25 A Yeah.

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1 engineer for the APS 3200?
2 A I don't recall exactly. Until the introduction
3 of version 4.1, at which point the system's effort went
4 to zero.
5 Q And when was that, approximately?
6 A Late '96.
7 Q All right. Is it fair to say that Mr. Crooks
8 was the systems engineer for the APS 3200 for
9 approximately two years?
10 A No. Initially he was support to Ed Edelman.
11 Only when Ed Edelman left did Branch Crooks take that
12 function.
13 Q For what period of time was Mr. Crooks the
14 system engineer for the APS 3200?
15 A I don't recall exactly when Ed Edelman left.
16 Q What did you mean when you said in an earlier
17 answer after the introduction of version 4.1 the
18 system's effort went to zero?
19 A Once a new version of software enters service,
20 there's no more development work for a while. There's
21 time to see how that version of software functions in
22 service. At that time there's no more design efforts,
23 systems design effort ongoing. It picks up later, when
24 John Szillat, we decided we needed another version of
25 software. We decided to do a design effort again.

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1 Q So is it fair to say that Mr. Crooks had the
2 job that Mr. Szillat has now?
3 A Yes.
4 Q And Mr. Crooks was the design engineer leading
5 up to the release of version 4.1 of the APS 3200 control
6 software; right?
7 A Yes.
8 Q And am I correct that in contrast to the time
9 after the release of that software, during the time
10 leading up to the release of that software, Mr. Crooks
11 would have had active responsibility in overseeing the
12 design and potential redesign of control software?
13 A Could you repeat it, please?
14 (Record read.)
15 MR. McCACKEN: Objection; vague.
16 THE WITNESS: Yes.
17 BY MR. PUTNAM:
18 Q Did Mr. Crooks retire after the release of
19 version 4.1? Or did he move on to some other position
20 within Sundstrand?
21 A He moved on to other positions.
22 Q Were they connected to the APS 3200?
23 A No.
24 Q Since the release of version 4.1, to your
25 knowledge, has Mr. Crooks had any responsibility, either

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1 A There are no major changes.
2 Q Are there any other changes of any sort that
3 you can specifically identify as you sit here?
4 A None that I can state as I sit here.
5 Q Are there any changes to the fuel control
6 start-up system contemplated as part of version 5 of the
7 3200 software?
8 A Yes.
9 Q What are those?
10 A The term "fuel control start-up" is very broad.
11 There is -- prior to the APU actually lighting off, we
12 have what's called an open loop schedule. We're making
13 a minor change to that open loop schedule.
14 Q What do you mean by an open loop schedule?
15 A I mean an amount of fuel input to the APU as a
16 function of speed. That is a function of what we call
17 manifold fill, which is the intention of filling the
18 fuel control lines with fuel prior to igniting the APU.
19 Q And what is the change that's being made to
20 that open loop schedule?
21 A An increase of amount of fuel that's measured
22 in pounds per hour. I don't recall exactly the numbers.
23 Q Are there any other changes that are being
24 contemplated to the fuel control start-up system as part
25 of version 5?

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1 as an employee or as a contractor, with regard to the
2 control systems for the APS 3200?
3 A Yes.
4 Q What is that?
5 A Very recently he's assisted in some testing of
6 the next version of software.
7 Q What version is that?
8 A It will be called version 5.
9 Q And that's a version of software that
10 Mr. Szillat is responsible for?
11 A Yes.
12 Q And are any changes to the surge control system
13 contemplated as part of version 5?
14 A I don't recall exactly.
15 Q Do you recall -- first of all, let me ask you
16 the yes or no question: Are any changes to the surge
17 control system contemplated as part of version 5?
18 A I don't recall exactly.
19 Q Do you recall generally?
20 A I believe there are some minor gain changes
21 within the proportional algorithms, but I would need to
22 go to a document to be sure.
23 Q Other than any changes of that nature, are
24 there any changes to the surge control system
25 contemplated for version 5?

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1 A Not that I recall.
2 Q I think you identified last time an individual
3 named Bernard Macarez. Do you remember that name?
4 A Yes.
5 Q Am I right that he was a Turbomeca employee who
6 worked on the APS 3200?
7 A Yes.
8 Q And what were his duties and responsibilities
9 with regard to the 3200?
10 A He was a liaison engineer, stationed in
11 San Diego, with the intention of making the partnership
12 work more seamlessly.
13 Q For how long did he play that role?
14 A I don't recall.
15 Q Several years?
16 A Probably 18 months. It wasn't that long.
17 Q What did he do after he -- the end of those 18
18 months?
19 A He went back to Turbomeca.
20 Q Did he continue to work on the APS 3200?
21 A No.
22 Q Can you identify the contributions made by
23 Mr. Macarez to the design and development of the APS
24 3200?
25 A No.

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31 (Pages 312 to 315)

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1 (Deposition Exhibit 49 marked.)

2 BY MR. PUTNAM:

3 Q Mr. Suttie, let me hand what you the court
4 reporter has marked as Suttie Deposition 49, which is an
5 April 4th, 1993 memo from Ed Edelman, with production
6 numbers HSA 351515 through HSA 351519. Do you have that
7 document in front of you?

8 A Yes.

9 Q If you turn -- first of all, can you tell me
10 what this document is, please?

11 A It appears to be a document defining the
12 differences between the interface control document we
13 discussed earlier and the then-software version 1.0.1,
14 which was a flight test.

15 Q When you say "software version 1.0.1, which was
16 a flight test," what do you mean?

17 A It never entered service. It was an Airbus for
18 flight test.

19 Q "It" being that version of the software;
20 correct?

21 A "It" being that version of the software.

22 Q If you turn to page HSA 351518, do you see a
23 chart labeled "load compressor surge control"?

24 A Yes.

25 Q And am I right that this is a version of the

1 there's a box that's labeled "latch"?

2 A Yes.

3 Q What is the -- how is that latch operating as
4 part of the surge control system depicted here?

5 A You need to work back through the logic diagram
6 to see how the latch is set and what causes it to be
7 reset through the "or" and "and" gates.

8 Q And what is it that causes it to be set or
9 reset.

10 A There's a parameter, DELPQP, as it's referred
11 to here, which is delta P on P. I need to go and find
12 exactly what that -- on these sheets exactly how that's
13 determined. As I remember, it's the point 35. As long
14 as delta P on P is above point 35, this latch would be
15 set. Additionally, there's the computation of B factor.

16 There are many limit values which are in
17 circular boxes with shading, BCVH -- I can't read that.
18 But any of these boxes that limits our threshold. And
19 there's the determination of B critical mentioned in the
20 table, that causes that latch to be set or un -- reset.

21 Q How does the latch affect the rest of the
22 operation of the surge control system in this diagram?

23 A Without working back in detail through it,
24 either a 1 or a 0 out of the latch, I'm not exactly
25 sure, causes the value LDOES to pass through to the

316

318

1 surge control system for the APS 3200 that utilized the
2 B factor and the B critical setpoint?

3 A Can you repeat the question?

(Record read.)

THE WITNESS: Yes.

6 BY MR. PUTNAM:

7 Q Is this an accurate depiction of the surge
8 control system that was used by the APS 3200 when it
9 first went into actual operation in January, 1994?

10 A I don't recall.

11 Q Do you see there's a chart with two columns, in
12 the lower right quadrant of the page, which has one
13 column headed IGV and one column headed BC?

14 A I do.

15 Q What is that chart depicting?

16 A The B critical value -- B critical value
17 changed as a function of IGV.

18 Q And do you see immediately to the left of that
19 there's a dotted line that connects two different parts
20 of the control diagram together?

21 A Yes.

22 Q Is that dotted line connected somehow to the
23 relationship between B critical and IGV?

24 A No.

25 Q Do you see at the bottom of the dotted line

1 bleed control value, or the value LDOES to be ignored
2 and the bleed valve to be put to the position KSRGMX.

3 Q And am I right in this diagram that the value
4 LDOES, if you trace that back, that is a function of the
5 proportional and integral control of delta P over P?

6 MR. McCACKEN: Objection; vague.

7 THE WITNESS: Not necessarily. As you can see,
8 there are many -- there are other paths that could cause
9 LDOES to be a different value.

10 BY MR. PUTNAM:

11 Q Am I right that LDOES in this diagram can be,
12 among other things, a function of delta P over P as
13 proportionally and integrally controlled?

14 MR. McCACKEN: Objection; vague.

15 THE WITNESS: Not delta P over P proportionally
16 and integrally controlled.

17 BY MR. PUTNAM:

18 Q I'm sorry?

19 A No.

20 Q Why not?

21 A Because it's not delta P over P that's
22 proportionally and integrally controlled. It's the
23 difference.

24 Q Okay. Am I right that LDOES in this diagram
25 can be, among other variabilities, a function of the

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1 proportional and integral control of the difference
2 between the measured and setpoint values of ΔP over
3 P ?

4 MR. McCACKEN: Objection; vague.

5 THE WITNESS: We discussed last time there's a
6 differential term, so it's proportional plus integral
7 plus differential control.

8 BY MR. PUTNAM:

9 Q Okay. Am I right that ΔP is in this diagram
10 can be, among other variables, a function of the
11 proportional integral and derivative control of the
12 difference between the measured and setpoint values of
13 ΔP over P ?

14 MR. McCACKEN: Objection; vague.

15 THE WITNESS: Yes.

16 MR. PUTNAM: Let's take a short break. We're
17 at a turning point.

18 MR. McCACKEN: Okay.

19 (Recess.)

20 (Deposition Exhibit 50 marked.)

21 BY MR. PUTNAM:

22 Q Mr. Suttie, let me hand what you the court
23 reporter has marked as Suttie Deposition Number 50,
24 which is labeled, "APS 200 design verification" and has
25 production numbers HSA 455702 through HSA 455761.

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1 Can you tell me whether you recognize that
2 document, sir?

3 A I don't recall it offhand.

4 Q If you turn to the third page of the document,
5 which is labeled HSA 455704. Do you see that you're
6 listed as receiving a copy of this document?

7 A Yes.

8 Q Are you familiar in general with a type of
9 document inside Sundstrand referred to as a design
10 verification document?

11 A Yes.

12 Q And what would be the purpose of a design
13 verification document?

14 A Normally a verification document is intended to
15 show that a product or system as implemented meets the
16 requirements that would be specified previously.

17 Q Is this a design verification document for the
18 APS 3200?

19 A Yes.

20 Q Can you turn, please, to Figure 1.2, which is
21 on page 19? And may be folded over, because it's
22 actually an oversize page, at least as it was produced
23 to us.

24 A Can you repeat that, please?

25 Q Sure. I want you to turn to page 19 HSA 455726

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1 in Suttie Exhibit 50.
2 A Okay.

3 Q You have that document in front of you?

4 A Pages 19.

5 Q And it's labeled at the bottom, "Figure 1.2:
6 APS 3200 control logic."

7 A Yes.

8 Q Can you tell me what this depicts generally?
9 A Generally it's the control algorithms included

10 in the ECB.

11 Q The control algorithms for the 3200 electronic
12 control box?

13 A Yes.

14 Q Am I right that the top portion of the page
15 relates to the start-up fuel control system for the APS
16 3200?

17 A Yes.

18 Q Now, on the top left of the top box, do you see
19 that there are two inputs being picked up there? One is
20 called PERSPD and one is called TIME. Do you see that?

21 A Yes.

22 Q Can you tell me what PERSPD means?

23 A Short for percent speed.

24 Q And what is it that's being measured there as
25 part of the APS 3200 fuel control start-up system?

322

1 A Speed.

2 Q And what is TIME? Is that just time?

3 A I assume so, yes.

4 Q And in the fuel control start-up system for the
5 APS 3200, as depicted here, what does the system do with
6 the measurement of percent speed and the measurement of
7 time?

8 A Nothing.

9 Q Why are those values being shown as being
10 measured and then combined in some way?

11 A Well, they're not. Time stops being time when
12 it goes into that box.

13 Q What happens in that box?

14 A There appears to be a look-up table. The axes
15 are not identified.

16 Q And do you see there's summing junction that's
17 a circle maybe an inch to the right of where it says
18 PERSPD?

19 A To the right of PERSPD?

20 Q Right. Yes, there's a summing junction that
21 says -- or there's a summary junction; do you see that?

22 A Yes.

23 Q And the value coming out of that ER1SPD; do see
24 that?

25 A Yes.

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HONEYWELL INTERNATIONAL V.
HAMILTON SUNDSTRAND

PETER J. SUTTIE
06/29/00

1 Q What does ER1SPD stand for?
2 A Error, speed error.
3 Q Am I right that in the APS 3200 fuel control
4 engine, engine start-up fuel control system, the APU
5 measures percent speed, measures time, and then
6 generates an error speed figure?
7 A No, you're not correct.
8 Q What was wrong with that statement?
9 A What is depicted here is not what is depicted
10 in the APS 3200 systems requirement specification. And
11 APS 3200 does not use time to generate a speed for -- to
12 be summed with the actual speed.
13 Q Well, am I right that at least as of the time
14 that this document was created in March, 1992, it was
15 contemplated that the APS 3200 would measure time as
16 part of the fuel control engine start-up logic?
17 A I don't believe so. I think if you look at the
18 dates of previous system specs, you'll find that this
19 is, in fact, in error.
20 Q When you say this is an error, what do you
21 mean?
22 A The fact that this implies time was generating
23 a speed value. As I mentioned during my last
24 deposition, it fundamentally can't work this way,
25 because different engines accelerate at a different

1 acceleration; correct?
2 A Correct.
3 Q And acceleration is the change in speed over
4 time; correct?
5 A It is the change in speed over the change in
6 time.
7 Q What do you mean by that?
8 A It's like delta speed divided by delta time.
9 Q So acceleration, as used by the APS 3200 fuel
10 control start-up system, is the change in speed of the
11 engine for a given interval of time; correct?
12 A Yes.
13 Q Am I correct that in order to measure
14 acceleration, the APS 3200 fuel control start-up system
15 needs to measure the speed at the start of an interval,
16 the speed at the end of the interval, and the time
17 elapsed during the interval?
18 MR. McCACKEN: Objection; vague.
19 THE WITNESS: What do you mean by time elapsed
20 during the interval?
21 BY MR. PUTNAM:
22 Q The length of the interval.
23 A Yes.
24 Q Am I correct that the APS 3200 fuel control
25 start-up system could not measure acceleration if it did

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1 rate. And so time is not a valuable function. You need
2 to look at speed alone. Because if an engine
3 accelerates slowly, a time-based algorithm can't
4 function.
5 Q Okay. When you say different engines
6 accelerate at different rates, do you mean different
7 APS 3200s will accelerate at different rates?
8 A Yes.
9 Q Why is that?
10 A Energy to the starter motor may be different.
11 The ambient temperature may be different. Humidity.
12 Many factors. Engine may be old. It may have greater
13 wear bearings. There are a multitude of reasons which
14 would cause an APU to accelerate at a different rate.
15 Q The fact, as you say, the different APS 3200s
16 accelerate at different rates, is that unique to the
17 APS 3200, or is it your contention that that would be
18 true of any type of APU?
19 A Any type of APU.
20 Q So is it your belief that an algorithm based on
21 time would not be an appropriate way to control the fuel
22 start-up logic for any APU?
23 A It's not a reliable way.
24 Q And as I understand your testimony, the
25 APS 3200, rather than being based on time, is based on

1 not know the length of the interval that separated the
2 two speed measurements?
3 A Correct.
4 Q In the APS 3200 fuel control start-up system,
5 am I right that the system increases fuel flow as a
6 function of the sensed acceleration?
7 A Can you define what you mean by function?
8 Q Am I right in the APS 3200 fuel control
9 start-up system, that fuel flow is scheduled based on
10 sensed acceleration?
11 A No.
12 Q Okay. What's the relationship between
13 acceleration and fuel flow in the APS 3200 fuel control
14 start-up system?
15 A The control system has a desired rate of
16 acceleration for the APU. The measured acceleration
17 we've just discussed, compared with the desired
18 acceleration, the error's computed, that error is fed
19 towards the fuel control; however, it need not control
20 fuel, because similarly EGT is measured, and the EGT
21 maximums, and so whichever of those two loops is
22 commanding the lower fuel flow will be the loop which
23 maintains control of the fuel control servo.
24 Q When you say fuel control servo, what do you
25 mean by servo?

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1 A Servo is the actuator that actually varies the
2 amount of fuel flow going into the APU.
3 Q So as I understand your testimony, in the APS
4 3200 fuel control start-up system, the difference
5 between the measured acceleration and the desired
6 acceleration can affect the fuel flow to the engine, but
7 it might not depending on certain other variables at
8 that time; correct?
9 A Correct.
10 Q Does the APS 3200 fuel control start-up system
11 have a schedule of the rate of fuel flow in relation to
12 the speed of the engine?
13 A No.
14 Q Does it have a schedule of the rate of fuel
15 flow in relation to the acceleration of the engine?
16 A No.
17 Q Does the APS 3200 fuel control start-up system
18 produce an error signal when the fuel flow rate gets to
19 be too high?
20 A No.
21 Q I've seen references in some documents to
22 minimum fuel -- minimum flow rate and maximum flow rate.
23 Are you familiar with those terms?
24 A Yes.
25 Q How are minimum and maximum flow rates used in

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1 extension occurring, which is when the combustor starts
2 burning because too much fuel was inserted into the
3 combustor.
4 Q And at that point the maximum fuel limit in the
5 APS 3200 operates to limit fuel flow to the engine;
6 correct?
7 A Yes.
8 Q Am I right in the APS 3200 engine start-up fuel
9 control system, the rate of fuel flow to the engine is
10 increased in relation to the rate of acceleration?
11 MR. McCACKEN: Objection; ambiguous and vague.
12 THE WITNESS: Can you repeat, please?
13 (Record read.)
14 THE WITNESS: Not necessarily.
15 BY MR. PUTNAM:
16 Q Okay. Am I right that in the APS 3200 engine
17 start-up fuel control system, the rate of fuel flow to
18 the engine is under certain conditions increased in
19 relation to the rate of acceleration?
20 MR. McCACKEN: Objection; ambiguous and vague.
21 THE WITNESS: Can you -- define what you mean
22 by "in relation to." I'm not understanding the
23 question.
24 BY MR. PUTNAM:
25 Q Am I right that in the APS 3200 system start-up

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1 the APS 3200 start-up fuel control system?
2 A They are limits which will prevent -- the
3 maximum fuel limit, will prevent a maximum -- it's a
4 maximum amount of fuel that the engine could tolerate at
5 that -- for that speed. It doesn't mean it's followed.
6 And typically it's not.
7 Q What do you mean, "It doesn't mean it's
8 followed?"
9 A The purpose of a control algorithm is to
10 schedule -- schedule is a bad word. Purpose of the
11 control algorithm is to put into the APU the correct
12 amount of fuel to maintain the acceleration or to
13 prevent over-temperature. That value is not -- the
14 actual value of that time is not particularly important.
15 What's important is maintaining the acceleration, or
16 maintaining an exhaust gas temperature. We don't
17 measure fuel flow. We can't schedule to a fuel flow,
18 because we don't actually know what it is. We can only
19 compute what we think it might be.
20 Q Am I right that the system in the APS 3200
21 operates to limit fuel flow if the maximum fuel limit is
22 exceeded?
23 A Yes. The maximum fuel limit is intended to
24 indicate a point at which the combustor could not take
25 any more fuel without a phenomenon known as rich

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1 fuel control system, the rate of fuel flow to the engine
2 is under certain conditions increased as a function of
3 the rate of acceleration?
4 MR. McCACKEN: Objection; ambiguous and vague.
5 THE WITNESS: Not necessarily increased.
6 BY MR. PUTNAM:
7 Q What do you mean by that?
8 A I believe if the acceleration rate is too fast,
9 we would actually cut back on fuel.
10 Q There is a relationship between the rate of
11 fuel flow and the rate of acceleration in the APS 3200;
12 correct?
13 A When you say rate of fuel flow, you mean with
14 respect to what?
15 Q The amount of fuel that's flowing into the
16 engine.
17 A The amount of fuel flowing into the engine at
18 any given time?
19 Q Yes.
20 A Then there is not a relationship between that
21 and acceleration.
22 Q What is there a relationship between, then?
23 MR. McCACKEN: Objection; vague.
24 THE WITNESS: What is there a relationship
25 between, what and what?

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35 (Pages 328 to 331)

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1 BY MR. PUTNAM:

2 Q Let me ask the question this way, Mr. Suttie:
3 Describe for me the role that acceleration plays in the
4 APS 3200 engine start-up fuel control system.5 A The ECB has a desired rate of acceleration,
6 which is designed to have a smooth and progressive start
7 of the APU. That is included in a look-up table in the
8 ECB specification. Actual acceleration, which as I
9 mentioned earlier can vary for many reasons, is compared
10 with the desired rate of acceleration. And depending on
11 the difference between those two numbers, in certain
12 circumstances, when EGT is far from the EGT limit, the
13 delta between acceleration required and acceleration
14 measured will have caused the servo current to change.
15 Servo is, as I mentioned, the actuation device on the
16 fuel control. So by servo current changing, in most
17 cases the fuel flow will change, either up or down,
18 depending on its command.19 Q Okay. Thank you. That's helpful. Have you
20 been involved in any analysis -- let me ask this
21 question first: Have you ever read the three Allied
22 Signal or Honeywell patents that are at issue in this
23 case?

24 A Yes.

25 Q Have you read all three of them?

1 the witness subject to the occurrence of the subjects I
2 mentioned just above. Thank you.

3 MR. McCACKEN: The record is complete.

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10 I, PETER J. SUTTIE, do hereby declare under
11 penalty of perjury that I have read the foregoing
12 transcript; that I have made such corrections as noted
13 herein, in ink, initialed by me, or attached hereto;
14 that my testimony as contained herein, as corrected, is
15 true and correct.16 EXECUTED this _____ day of _____
17 2000, at _____

(city)

(state)

18

19 PETER J. SUTTIE
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36 (Pages 332 to 335)

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HAMILTON SUNDSTRAND

PETER J. SUTTIE
06/29/00

1 STATE OF CALIFORNIA)
2 : ss
3 COUNTY OF SAN DIEGO)

4 I, the undersigned, a Certified Shorthand
5 Reporter of the State of California, do hereby certify:
6 That the foregoing proceedings were taken
7 before me at the time and place herein set forth; that
8 any witnesses in the foregoing proceedings, prior to
9 testifying, were placed under oath; that a verbatim
10 record of the proceedings was made by me using machine
11 shorthand which was thereafter transcribed under my
12 direction; further, that the foregoing is an accurate
13 transcription thereof.

14 I further certify that I am neither financially
15 interested in the action nor a relative or employee of
16 any attorney of any of the parties.

17 IN WITNESS WHEREOF, I have this date subscribed
18 my name.

19
20 Dated: _____

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22
23
24 RENEE KELCH
25 CSR No. 5063

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